PATIENT BED WITH LEG LIFTER

[0001] This application is a divisional application of Serial Number 09/796,368, now U.S. Patent 6691349 and a continuation-in-part application of Serial No. 08/835,991, filed on April 11, 1997, now U.S. Patent 5,996,150.

FIELD OF THE INVENTION

[0002] This invention relates to a mobile bed and chair combination for patients in hospitals, nursing homes, or similar health care facilities including the home in which the safe transfer of the patient from a hospital type bed is contemplated by a single healthcare giver.

BACKGROUND OF THE INVENTION

[0003] There are various devices known in the art for transporting the disabled from one place to another. The most commonly known is the wheelchair either powered or non-powered. In the hospital and nursing homes, gurneys are used to transfers the patient from one place to another while remaining in a lying or prone position. Often it is necessary to transfer the patient from the hospital bed to a gurney type bed of wheelchair. Studies have shown that upwards to fifty percent of all injuries to either patients or healthcare people have occurred when the patient is being transferred from the bed to a gurney or to a wheelchair. That is, when a patient is transferred from a bed to a wheelchair, the patient must first be raised to a sitting position, rotated so that their feet are over the side of the bed, and then lifted form the bed to the chair. This usually requires three people for a safe transfer, two to lift the patient off the bed, and one to rotate the patient and gently guide him into the chair. Similarly, if the patient is to be transferred from a bed to a gurney, two and sometimes three

people are required for a safe transfer, two to lift the patient and one to stabilize the gurney.

[0004] Unfortunately, the realities of the healthcare situation in our country and indeed over the world, have stretched the healthcare dollar so thin that many of our provider institutions can no longer provide the necessary personnel to ensure the safe transfer of patients in the above described situations. Instead of the two or three people required to perform the patient transfer, often only one is available. As is often the case, the patient is of a size or weight that is difficult for the healthcare giver to manage by him or herself. The result is either the patient is dropped or the healthcare person sustains a back injury. Such a state of affairs only exacerbates an already strained industry in terms of lost time and money for both the healthcare giver and institution; and the ill will of, or a lawsuit by, the patient should further injury result.

[0005] The prior art has attempted to relieve the situation by providing combination wheelchair and bed mechanisms. For example, the patent to Crawford et al, U.S. Patent No. 5,402,544, discloses a combination chair and gurney which permits one device to operate both as a wheelchair and as a gurney. The object of Crawford et al is to attend to the bodily needs of a disabled person. In Crawford et al, the chair can be converted to a bed and then hand cranked to a height to correspond to a bed height. The mobile bed is then placed adjacent the bed and held stabilized by "elastic bungee cords" connected between the rails of the bed and the Crawford et al device (col. 5 line 25 of Crawford et al). The problem with Crawford et al is that there is still a gap between the two beds, and an uncomfortable obstacle in the form of the rails to negotiate in the patient transfer. Moreover, there is, over time, a very real possibility of the bungee cord breaking with disastrous consequences. Another patent to Ezenwa, U.S. Patent No. 5,193,633, is designed in particular for paraplegics in a home environment. This patent

also shows a chair converting to an adjustable height bed device, and, has a lateral shifting mechanism for use in the wheelchair mode so that the each of reaching over the head by the disabled can be effected. This lateral shifting is stabilized as to the center of gravity by a tilting of the chair toward the center of the wheeled platform. See Figs. 6 and 7 of Ezenwa. Thus, while this feature is effective for the patient when he reaches high over his head to keep him stabilized, it is counterproductive to the transfer of the patient from the mobile bed to another bed because it presents both a gap between the beds and a raised obstacle therebetween (due to the tilting). This patent like Crawford et al above is seen to require at least two or maybe three people to effectuate a safe transfer of the patient. Another prior art attempt to address the problem of transporting patients from a bed to a convertible wheelchair/bed structure is disclosed by a patent to Jones, U.S. Patent 4,119,342. In this patent, the wheelchair converts to a bed mode of a fixed height (equal to the height of the wheelchair arms). Thus, it is required that the bed in which the patient is lying be lower than this fixed height, so that the bed mode will then hang over the bed by up to seven inches to perform the transfer. This apparatus suffers from three drawbacks. One, the bed must be lower in height than the Jones device because the device is not adjustable; two, assuming the bed is lower, the obstacle created by the thickness of the platform structure (wheelchair arms and pad) would cause a difficult transfer procedure, if not insurmountable if the bed is even one or two inches below the Jones' bed platform; and three, a seven inch overlap has been found by the inventors hereof to be inadequate to ensure a safe patient transfer by one person. This is because in maneuvering the patient onto beds of different heights, there is usually slippage between the bed structures when one person attempts the transfer. Thus, it is seen that, once again, two and probably three people would be required to safely effect a patient transfer in Jones. Other adjustable height wheelchair to bed

structures are disclosed by Burke et al, U.S. Patent 5,342,114, and Herbert et al, U.S. Patent 5,179,745. These patented structures, like Crawford et al, above, are only able to be located next to the bed in which the patient is lying. Moreover, these prior art teachings, unlike Crawford et al, have no bungee cords to help hold the two bed structures together. Thus, a minimum of three people are seen needed to transfer a patient from one bed to the other.

SUMMARY OF THE INVENTION

[0006] The present invention is directed to a cantilevered mobile bed/chair that, while in its bed mode, is able to overhang a conventional thirty six inch width hospital type bed by up to half its width in cantilevered fashion so that a safe transfer of a patient can be effected, even by a single caregiver. After the transfer, the patient can then be transported by either remaining in the bed mode, or converted into a chair mode for further patient care. The objects of this invention are carried out by a unique lift structure providing cantilever support for a series of three hinged together platforms making up back, seat and foot portions of the chair/bed. The lift structure comprises a telescoping tower which mounts vertically on one side of a rectangular shaped wheeled base. The platforms comprise the patient support for the bed/chair, and are operatively coupled to an E-shaped frame structure that in turn is mounted in cantilever fashion horizontally from the telescoping tower controlled by a screw type jack associated therewith. While a screw jack is provided, it is obvious that other jacks such as hydraulic and scissors may be employed. With this offset tower and cantilever E frame design, the remote side (to the tower of the platforms of the apparatus int eh bed mode are able to overlap a hospital type bed by up to eighteen inches, or half the bed width of a conventional, thirty six inch wide hospital type bed. Thus, when it is desired to transfer a patient from or to a hospital type bed to the apparatus, the jack controlling the telescoping tower operates to raise the platforms above the bed, the apparatus wheeled over to overlap the bed by up to eighteen inches, and then lowered to press into the bed's mattress. Moreover, the platforms comprising the bed are of a thin, highly strong material in which the side edges thereof are beveled or angled downward. This angle down design enables the platforms to further press into the mattress of the hospital type bed, not only ensuing that virtually no movement occurs therebetween, but

that a substantially flat profile is presented for the two beds even with a one inch pad on the mobile bed. With such a relatively flat profile, and with the two beds locked in such a tight embrace, it becomes an easy matter for just one caregiver to manage a patient in a transfer procedure.

[0007] Although the lift mechanism of the invention can be carried out manually, the best mode comprises an electrically powered lift arrangement. That is, an electric motor is mounted to control a screw jack which is powered by a battery located at the wheeled base of the apparatus. The three platforms forming the head, seat and foot supports are connected by low profile piano hinges. Another electrically driven screw jack is mounted below the seat platform and controls the conversion of the bed into a chair configuration by way of levers and hinges. This second jack, like the first one, is mounted near the tower side of the unit so as to not interfere with the cantilevered overhang portion of the platforms. The chair mode may be under the control of either the caregiver or the patient, and features indefinite adjustment for patient comfort. In the case of immobilized patients, there is an auto seat reposition timer feature associated with the chair mode that periodically readjusts the sitting position to minimize bedsores. The seat platform includes a potty hole for increased patient maintenance. The wheeled base, besides providing support for the tower, accommodates, four, omni-directional wheels that may, in some models, be electrically powered; a hazard-free dry-cell, rechargeable battery and holder therefor; and a battery recharging unit. The back platform has provision for an oxygen bottle, while the foot platform includes an adjustable foot rest. The platforms comprising the bed include VELCRO straps for patient safety. The tower also accommodates an IV holder; combination food tray holder and arm rest that swings into position as needed; and a module for the auto seat reposition timer mentioned above.

[0008] Another object of the invention is to provide for a Trendelenburg position bed or where the bed is positioned to have the head lower than the feet. This is accomplished in the bed mode, one of several ways; one, by providing a multi-position gear and locking pin mechanism connected between the tower and E frame, or two, by way of a swing down jack mounted on the E frame. Thus, for example, in the case of the pin and gear arrangement, the pin is pulled and the E frame which is connected to the gear is rotated to be tilted to the desired position, and the pin reinserted to lock the bed in the Trendelenburg position.

[0009] A further object of the invention is to allow for portability of the apparatus by keeping the weight to about 160 pounds, yet of sufficient strength to support a load of up to 1500 pounds.

[0010] Other objects, features and advantages of the invention will be apparent from the following specification and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] **FIGURE 1** is a perspective view of the cantilevered mobile bed/chair apparatus in accordance wit the invention shown in the chair mode;

[0012] **FIGURE 2** is a front view of the apparatus showing the bed mode converting to the chair mode in phantom;

[0013] **FIGURE 3** is a side view of the apparatus showing the cantilevered bed/chair in the bed mode at two different heights;

[0014] **FIGURES 4A-4D** shows a step by step procedure for the safe transfer of a patient from the cantilevered bed/chair apparatus to a hospital type bed;

[0015] **FIGURE 5** shows respectively cut-away side view sections of the adjustable foot rest, and wheel and lock mechanism forming a part of the invention;

[0016] **FIGURE 6** is a partial top view of the three hinged together platforms forming the patient support with the middle seat section showing an oval shaped potty hole;

[0017] **FIGURE 6A** is a view of a bed pan useable with the cantilevered bed/chair apparatus;

[0018] **FIGURE 6B** is a view of the bed pan in Figure 6a in use with the cantilevered bed/chair;

[0019] **FIGURE 7A-7B** show one method of operating the bed/chair apparatus in the Trendelenburg position;

[0020] **FIGURE 8** shows a second method of operating the bed/chair apparatus in the Trendelenburg position;

[0021] **FIGURE 9** shows an embodiment of the invention having a base with three rails positioned about a toilet;

[0022] **FIGURE 10** shows the cantilevered bed/chair having three rails positioned sideways about a toilet;

[0023] **FIGURE 11** shows an embodiment of the cantilevered bed/chair having large wheels attached to the bed frame;

[0024] **FIGURE 12** shows an embodiment of Figure 11 with the wheels engaged with the ground;

[0025] **FIGURE 13** shows a back view of the embodiment shown in Figure 11;

[0026] **FIGURE 14** is a rear view of the embodiment of Figure 12;

[0027] **FIGURE 15A** is a side view of a wheelchair apparatus having a lift assist mechanism;

[0028] **FIGURE 15B** is a front view of a wheelchair having a lift assist mechanism;

[0029] **FIGURE 16A** is a side view of the lift assist mechanism raised;

[0030] **FIGURE 16B** is a front view of the lift assist mechanism raised;

[0031] **FIGURES 17-19** depict a mechanism for raising a patient's knees upward;

[0032] **FIGURE 20** shows the mobile bed apparatus having railings; and

[0033] **FIGURE 21-24** show an alternative embodiment of a patient leg lift.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0034] Turning to Figure 1, the overall cantilevered bed/chair apparatus is indicated by **1**. A rectangular base **2**, made from steel or an equivalent material, provides support for four omni-directional wheels **3**, each with a locking mechanism **4**. The wheels, seen in greater detail in a cut-away section view in Figure 5, are five inches in diameter, and are conventional off-the-shelf items such as No. 3W804 Swivel Stretcher Caster with Central Locking System Stem by Wagner. While not shown in the preferred embodiment, the wheels may be motorized in any well known manner, such as shown by the Ezenwa patent referred to above to convert the apparatus to a powered wheelchair. A tray **2A** nestles within base **2** to provide support for a 12 volt, dry cell battery and battery charger generally indicated at **5**. The battery and charger therefor are conventionally known, such as the "Jump-N-Carry 400" from K & K Jump Start/Chargers, Inc. of Kansas City, Missouri. A telescoping tower **6A-6B**, made of three and one-half inch square steel for upper section **6A**, and three inch square steel for lower section **6B**, and, designed to lift 2500 pounds, is mounted on one side of rectangular base **2**. Aluminum or other materials may be used instead of steel for the tower without departing from the spirit and scope of the invention herein. The telescoping sections **6A** and **6B** are raised and lowered by way of a jack **8** supported by a block **7**. Jack **8** in the best mode of operation embodiment is a motorized screw jack that is capable of working either by hand or with a motor **9**. The motorized jack is a known 12 volt DC motorized jack, such as "Hi-Torque Acme Power Jack" made by H & H Engineering of Battle Creek, Michigan.

[0035] Attached to the tower in cantilever fashion, at about mid-way, is an E shaped frame having a back **10** and arms **11**. Two of the arms **11** are located under, and are attached to a seat platform **19** on either side of a potty hole **21**. These arms are

made of steel, and are L-shaped in cross section for strength. While L-shaped channel steel is shown, it is apparent that other well known designs for strength, and materials may be employed with equal results. The third arm **11** for the E-shaped frame is located approximately midway along a back platform **18**, and provides operative support therefor when in the bed mode. The back and seat platforms **18** and **19** are hinged together by a piano hinge, shown in detail in Figure 6. The seat platform is then connected also by piano hinge to a foot platform **20**. The three platforms are made of 3/8 inch aluminum with beveled down edges, and measures twenty four and one-half inches wide by three feet long for back platform **18**, eighteen inches long for seat platform **19**, and eighteen inches long for foot platform **20**, for a total of six feet in length. The beveled edges of the platforms perform a dual purpose, viz.; for providing rigidity for the platforms, and, for effecting an important aspect of the operation of the apparatus, to be described later with respect to FIGS. 4A-4D. While aluminum is disclosed for the material used in the platforms, it is apparent that other materials may be used including steel, plastic or fibreglass without departing from the spirit and scope of the invention. Arms **11** connected to back **10** of an E shaped frame extend approximately two thirds the width of the platforms, and together with platforms **18-19-20**, are designed to support a load of 1500 pounds. The three platforms are caused to change position by way of pivoting levers **17A-17B** connected to back and foot platforms **18** and **20** by way of anchor blocks **16A** and **16B** respectively. Anchor blocks **16A-16B** are connected approximately four inches from the tower side of the platforms. The location of anchor blocks **16A-16B** is important because this will leave approximately 18 inches cantilever overhang for the remainder of the platforms that is free of all obstacles. This can be more clearly seen in Figure 3. A second jack **13** controls the movement of pivoting layers **17A-17B**. Jack **13**, like jack **8**, is a screw jack that is mounted

to back **10** of the E frame with block **12**, and is controllable, also like jack **8**, either by hand or by a motor **15** supported at **14**. It is apparent that other classes of jacks may be employed, such as hydraulic and scissors without departing from the spirit and scope of the invention.

[0036] Attached to back platform **18** is a swing away safety guard rail **22** that encircles the patient for safety, while attached to tower **6A** is a swing away food tray holder and arm rest combination **23-24** for patient service. An adjustable foot rest **25** attaches to foot platform **20** in a manner described further down with respect to Figure 5. An oxygen tank holder **26** is conveniently attached longitudinally along the tower side and near the top of back platform **18**. An electronic auto seat reposition timer module **27** attaches to the back of tower section **6A**, while an IV holder **36** attaches to the front of tower section **6A**. Time module **27** is an off-the-shelf item such as "Universal Timer, Model UT-1" from Alarm Controls Corp., Deer Park, New York. This timer controls the periodic repositioning of the bed/chair apparatus when in the chair mode, so that bed sores of an immobilized patient are minimized. Not shown in order to minimize clutter in the figures, are VELCRO safety straps attachable at various points along platforms **18-19-20**. For example, the inventors hereof have attached their VELCRO safety straps at the back and foot platforms. It is apparent that such straps may be attached anywhere for optimum patient safety without departing from the spirit and scope of the invention.

OPERATION OF CANTILEVERED MOBILE BED/CHAIR

[0037] The operation of the cantilevered bed/chair will be described with reference to Figures 2-8. Some of the reference numbers for already identified elements have been omitted in order to keep figure clutter to a minimum. Looking at Figure 2, the bed/chair apparatus is shown in the bed mode converting to a chair mode seen in phantom lines. It is noted that back platform **18** and foot platform **20** pivot about seat platform **19** which is securely mounted to the E shaped frame. The back and foot platforms move in opposite directions by action of under the seat jack **13** connected to levers **17A-17B** (identified in Figure 1). Thus, as the jack extends, the platforms flatten out to form a bed. A chair is formed when the jack contracts. Jack **13** and connecting levers and blocks are all mounted near tower **6A-6B** so as to permit maximum cantilever overhang. This is clearly seen in Figure 3 which shows an eighteen inch overhang for the cantilevered platforms. Also seen in Figure 3, is a nine inch height for wheeled base **2** and battery/battery charger **5** combination to enable clearance under a typical hospital bed with a lowered guard rail. Figure 3 depicts the cantilevered bed/chair in the bed mode at two different heights. The height is controlled as jack **8** extends to expand telescoping tower **6A-6B**. That is, patient platforms **18-19-20**, supported by E shaped frame **10-11** attached to section **6A** of the telescoping tower, changes height as section **6B** of the telescoping tower remains fixed to base **2**. The bed has a vinyl covered foam pad **28** of about one inch thickness for patient comfort.

[0038] Figures 4A-4D show the typical patient transfer procedure for the invention. Figure 4A shows the patient being transferred in gurney fashion to a hospital type bed with the guard rail up. The height of the cantilevered bed is raised, in Figure 4B, above the hospital type bed by up to eighteen inches as shown in Figure 4C, and then lowered so as to press into the

mattress of the hospital type bed. The pressing in feature of the cantilevered bed is enhanced by the beveled or angled down edges **35** of platforms **18-19-20**. It has been found that with the beveled edges pressing into the mattress, together with the relatively thin construction of the platforms (3/8 inch thick aluminum), the side profile of the two beds is almost flat even with a one inch foam pad on the cantilevered bed. Moreover, because the beveled edges "bite" into the hospital type bed's mattress, virtually no movement occurs between the two beds, which greatly facilitates the patient transfer procedure, even by one caregiver. Thus, in Figure 4D, safety rail **22** and food tray holder/arm rest rail **23/24** are swung back, and the patient is easily rolled over onto the hospital type bed. Should it be necessary to move a patient from a hospital type bed to the cantilevered bed apparatus, the above described procedure would be reversed.

[0039] Figure 5 shows the adjustable foot rest feature of the invention. Since patients come in many different heights, foot rest **25** attaches to a lower bar **29B** which slides telescopically in box shaped channel **29A** fixed underneath foot platform **20**. Thus, if a patient is taller than average, the foot rest is extended and locked in position to provide appropriate foot support. The foot rest is shown with a twelve inch adjustment. This provides accommodation for patients of up to seven feet in height. It is obvious that greater adjustments may be made with foot rests constructed with larger dimensions for bar **29B**. As noted above in the description of Figure 1, wheel 3, also shown in Figure 5, has a diameter of five inches. This has been found sufficient to accommodate the many different type floor surfaces of most provider institutions.

[0040] Figure 6 shows piano hinges **38** and **39** which, as is well known, have an almost flat profile, yet are extremely strong. These hinges, as mentioned above interconnect platforms **18, 19**

and **20**, and are capable of a long, trouble free useful life. Seat platform **19** has an eight inch by twelve inch elliptical potty hole **21**, useful for increased patient maintenance.

[0041] Figure 6A discloses a bedpan specifically designed for use with the bed/chair of the invention. The bedpan has a flange **40** and receptacle **41**. The cross-sectional shape of the receptacle **41** is substantially identical to the shape of the potty hole **21**. Figure 6B shows the bedpan in use with the bed/chair. In use, the receptacle **41** extends through the hole **21** and the flange **40** rests upon the platform **19**. The large flat flange provides for comfortable use by the patient. The bedpan is easily installed and removed as necessary.

[0042] Figures 7 and 8 describe two methods of performing the Trendelenburg position that may be employed in the apparatus herein. This is the position where the head of a patient is made lower than their feet, such as is necessary with some patients suffering from certain heart conditions, or patients in shock. In Figures 7A-7B, the Trendelenburg position can be effected with a simple, yet effective swing down bar or jack **32**. The bar is normally in a raised horizontal position next to E shaped frame back **10**. When it is desired to employ its use, bar **32** is swung down in a vertical position in front of and between the front wheels as shown in Figure 7A. As the tower is lowered, bar **32** at first makes contact with the floor, and then begins jacking the front half of the apparatus off the floor as shown in Figure 7B. A second method for effecting the Trendelenburg position is shown in Figure 8. This method employs a gear and locking pin arrangement in which a gear **33** is fixed to E shaped frame back **10**, and to tower **6A** by way of a center load bearing or axle. When it is desired to employ the Trendelenburg position, a pin **34** is pulled from a center hole of a series of holes, the platforms tilted to the appropriate position, and the pin reinserted in an off-center hole as shown. Other obvious methods may be employed without departing from the spirit and scope of

the inventive apparatus herein. For example, means may be provided for raising the foot platform above the horizontal plane so that the patients legs are raised above their head. Such a means might take the form of a third screw jack connected between a modified lever **17B** and the foot platform, to thereby cause only the foot platform to raise when the third jack is extended.

[0043] Figures 9 and 10 disclose an embodiment of the bed/chair having a base that can surround a toilet thereby placing the seat platform **19** over the toilet. The base of the bed/chair has three rails forming a U-shape with a wheel **3** at each corner of the base. This differs from the base shown in Figure 1 in that the rail **2** and battery platform **2A** are deleted. This can be accomplished in two ways. The base can be formed in this manner and the battery **5** can be moved to a different location, such as mounted on one of the remaining rails of the base. Also, the rail **2** and battery platform **2A** can be made to be removable. When it is desired to position the bed/chair about a toilet, the rail and platform would be moved and the bed is so positioned. Afterwards, the rail and battery platform could be reattached.

[0044] Figure 9 shows the bed/chair positioned with the back platform **18** resting against the tank of the toilet. In this manner, the leg platform **20** extends in front of the toilet and the seat platform **19** is positioned over the toilet **42**. In an alternative use of the same device, the bed/chair can be positioned so that the tower **6A** is in front of the toilet and the two sides of the base extend along either side of the toilet. In this manner, the seat platform **19** and potty hole **21** are still positioned over the toilet **42**. Either of these arrangements could be used depending on the ease in maneuvering the bed/chair into position. The result in either position is the same in that the seat platform **19** is positioned over the toilet. The patient can choose either position depending upon what is most convenient.

[0045] Figures 11-14 disclose a bed/chair that allows forward movement by the patient. In this embodiment, a large wheel **50**, common to the type used as rear wheels in wheel chairs, is connected to the frame. As the bed frame is lowered, the large wheel **50** engages the ground and, as the frame is further lowered, the rear wheels are lifted off the ground. This arrangement is shown in Figure 12. Once the rear wheels are lifted off the ground, the patient can roll the bed/chair forward by rolling the wheels **50**. The top of the wheels **50** extend above the seat platform **19** and are easily accessible by the patient.

[0046] The rear view of this embodiment is shown in Figure 13. In this figure, it is seen that the wheels **50** are connected to a pair of axles **52**, one on each side of the bed/chair. The two axles are connected by a common rod **51**. It is envisioned that quick release wheels **50** are used so that they may be easily attached and detached from the axle **52**. Such wheels are conventionally known in the art.

[0047] Figures 15A-16B disclose a lift mechanism for a wheelchair. The wheelchair **60** has a seat portion **65** and a back rest portion **65** and pivotable armrests **63**. A series of straps **66** are used to help retain a patient in the chair. The lift assist mechanism consists of a platform **64** lifted by a motor **67**. Any number of conventional means **68** are used to connect the motor **67** with the platform **64**, such as a screw jack or pump jack.

[0048] Positioned between the seat **65** and the platform **64** is a spring **70**. The spring **70** has a lifting force of 40-50 pounds. While this force is not sufficient alone to lift a patient, it reduces the amount of weight that is lifted by the motor **67**. Under normal conditions, the patient's weight collapses the spring but during lifting the spring aids the motor in lifting a patient. When lifting of the patient is desired, the armrests **63** are pivoted backwards out of the way. The motor is engaged and the platform **64** is lifted up the rail **68** to a height so that

the patient clears the frame of the wheelchair. Once lifted to the height **69**, the patient can be slid laterally onto another chair or bed. Such a device consisting of the seat platform **65**, the lifting platform **64**, the motor **67**, spring **70** and rail **68** can be retrofitted onto an existing wheelchair or any other type of chair.

[0049] Figures 17-19 show a mechanism for lifting the patient's legs. The device includes a tube **80** attached to the head platform **18** of the bed/chair. Fitting within and attached to the tube **80** is a right angle rod **81**. At the end of the cantilevered section of the rod **81** is a hook **85**. A ring **82** fits onto the hook **85**. Extending from the ring **82** are two flexible cables **83**. A padded rod **84** is connected between the ends of the flexible cables **83** to provide a triangle support.

[0050] As shown in Figure 18, when the bed/chair is in the chair configuration, the padded rod **84** is positioned beneath the knees of the patient **100**. As the head platform **18** is lowered, the tube **80** is moved to a near horizontal position. This results in the right angle rod **81** extending upwardly and the hook **85** positioned above the patient's head. The cables **83** pull the padded rod **84** and therefore the patient's knees upwardly. The tendency for the patient's legs to want to fall back to a horizontal position maintains tension in the flexible cables **83**. In such a position, the patient **100** can be cleaned and any sheets on the bed/chair can be more readily changed.

[0051] Other features are envisioned for the cantilevered mobile bed/chair apparatus herein. For example, a means for weighing patients while on the apparatus has been successfully tested. Such a means involves a set of two, six inch strain gauge strips glued to the front and back side of tower section **6B** near base **2**. The strain gauges are connected to a highly sensitive Wheatstone bridge circuit so that any strain on the tower due to a load (such as a patient) on the platforms,

translates to a weight on an appropriate scale. Such strain gauges and Wheatstone bridge circuits are known in the art, and may be commercially obtained from e.g., Omega Engineering, Inc. of Stamford, Connecticut.

[0052] The cantilevered mobile bed/chair apparatus disclosed herein weighs only about 160 pounds so as to be portable, and thereby be useful under numerous circumstances and environments. And, despite its many sophisticated features, and its ability to support a load of 1500 pounds, the apparatus herein is designed to be rugged and long lasting.

[0053] An embodiment having rails surrounding the seat is shown in Figure 20. As can be seen, the head platform of the patient support **18** is provided with a U-shaped rail **22** that extends along each side and the top of the platform. On the far side of the platform, as shown in Figure 20, the rail **22** is pivotally attached to the head platform **18**. This allows the railing to be moved out of the way during patient transport on and off the patient support. Arm rests **200** are attached to the bottom of the U-shaped rail **22**. The arm rests have pads **203** for the comfort of the patient. More importantly, the arm rests are attached to the rail **22** by a pivoted connection to collar **204**. Collar **204** is slidably maintained on the rail **22** and pivotally connected to the arm rests by pin **205**. As the angle of the head portion **18** relative to the seat portion **19** is changed from the seat to the bed configuration, the collar slides downwardly along the rail. As can be seen, one side is provided with a downwardly depending portion. The collar **204** can slide along the rail until the top of the arm rail **201** is substantially co-linear with the two side portions of the rail **22**.

[0054] Figures 21-24 disclose an alternative patient leg support. The mechanism itself is shown in Figure 21. The mechanism has a first L-shaped member **203** and a main member **206**. A padded member **204** extends from the end of main member **206**. Padded member **204** can rotate to accommodate its changing angle.

It is best for the comfort of the patient that the padded platform **204** remain parallel to the seat platform **19**. Since the angle of the main member **206** changes as it is used to raise the patient's legs, it needs to be pivotally connected. The angle of the main member **206** relative to the L-shaped member **203** is accomplished by the pivoting joint **201**. The pivoting joint has an extension **202** for attaching the leg lifting apparatus to the bed, and can be locked to maintain the position of the main member **206** relative to the L-shaped member **203**. The range of motion is shown by arrow **207** and the pivot joint **201** does have a ratchet action.

[0055] Figure 22 shows the patient support in the flat, bed configuration. As can be seen, the main member **206** extends along the side of the platform so that the padded platform **204** is positioned below the patient's knees. In this configuration, the main member **206** is substantially coplanar with the L-shaped member **203**.

[0056] The mechanisms as used when the device is in the seat configuration is shown in Figure 23. The padded platform **204** remains below the patient's knees, as can be seen, the angle of the padded platform **204** is now different as it is perpendicular to the main member **206**. This maintains the padded platform **204** in the best position for the patient's comfort. Also seen is the angle of the main member **206** relative to the L-shaped member **203**. The L-shaped member **206** is parallel to the head platform **18** whereas the main member **206** is parallel to the seat platform **19**.

[0057] If the main member **206** and L-shaped member **203** are locked in the position shown in Figure 23, the device can be used to lift the patient's legs in an easy manner. If the head platform **18** is lowered until it is substantially coplanar with the seat platform **19**, the seat platform will push against the L-shaped member **203** and the main member **206** will extend upwardly above the patient support. This configuration is shown in Figure

24. Throughout the transition, the padded platform **204** can pivot so that it remains in contact with the patient's legs for the patient's comfort. The bottom of the patient's legs now have their weight supported on the platform **204**. In this manner, the patient's legs are lifted and maintained in a raised position.

[0058] While this invention has been described in conjunction with a preferred embodiment, it is obvious that modifications and changes may be made by those skilled in the art to which it pertains, without departing from the spirit and scope of this invention, as defined by the claims appended hereto.